Mental control of a single electron?

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ABSTRACT

Over the years there have been numerous accounts of certain individuals' purportedly being able to affect material bodies by mental intent alone. I propose to look for such an effect, but with an experiment requiring far less energy than needed in previous accounts, some 23 orders of magnitude less. The experiment is to mentally flip the spin of the valence electron of a single Mg^+ ion undergoing laser-induced fluorescence (LIF) at 280nm in a 50-gauss magnetic field. Flipping the spin would turn off the LIF. If the person could flip the electron's spin again, restoring LIF, then spin flips creating long and short intervals of LIF could send a message in International Morse Code. If the person could also control the ion's LIF at a distance, as suggested by frequent reports of distant healing, *etc.*, then it would appear that his or her intent is not mediated by the electromagnetic, weak, strong, or gravitational field. Instead a new kind of field might be responsible. It might propagate as a soliton, since solitons do not weaken with distance.

RÉSUMÉ

Depuis un certain nombre d'années, de nombreux rapports ont paru relatant la capacité de certains individus à pouvoir apparemment influer sur des corps matériels grâce à leur seule pensée. Je propose une telle expérience à la recherche de cet effet, mais dont les besoins en énergie seraient bien moindre que lors d'essais précédents, puisque réduits de quelque 23 ordres de magnitude. L'expérience consiste à mentalement renverser le spin de l'électron de valence d'un seul ion Mg^+ soumis à une fluorescence induite par laser (FIL) à 280 nm dans un champ magnétique de 50 gauss. Le renversement du spin ferait cesser la FIL. Si la personne pouvait renverser le spin de l'électron de nouveau, rétablissant la FIL, alors des renversements de spin successifs, créant des intervalles longs et courts de la FIL, pourraient envoyer un message en code Morse international. Si la personne parvenait également à contrôler la FIL de l'électron à distance, ainsi que le suggèrent, par example, de nombreux rapports de guérison à distance, il semblerait alors que son intention n'est transmise ni par les champs électromagnétique et gravitationnel, ni par les interactions faible et forte. Un champ d'un genre nouveau pourrait en être responsable. Il pourrait se propager comme un soliton, puisque les solitons ne s'affaiblissent pas avec la distance.

KEYWORDS: laser-induced fluorescence, entanglement, soliton, mental intent

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1. INTRODUCTION

There are quiet but persistent accounts of some people's being able to do things which seem to have no explanation in contemporary science -- special capabilities that are independent of the five senses: sight, hearing, smell, taste, touch. These purported abilities include remote viewing or clairvoyance, clairaudience, mental telepathy, and psychokinesis (PK) or mental effect on matter. Evidence for these effects has been largly anecdotal over the centuries. However recently there have been a few tests of such phenomena carried out in a scientifically controlled fashion, for example, the distant-healing PK experiments summarized by Dossey[1] and reported in detail by Jonas and Crawford[2]. (W. B. Jonas is the former director of the Office of Alternative Medicine at the U. S. National Institutes of Health.) Jonas and Crawford reviewed a series of meta-analyses, including a study of thirteen randomized double-blind trials looking for the effect of distant healing and prayer on 2328 patients. On the face of it, such healing would seem to be impossible and contrary to all science. Yet six of the thirteen trials reported statistically significant effects, *i. e.*, patients getting out of the hospital in fewer days, requiring less medication, with fewer follow-up visits, fewer secondary illnesses, *etc.*

Just as incredible is the report that Chinese medical doctor and qi-gong master Xin Yan significantly altered the structure of water in sealed tubes some seven kilometers away.[3,4] Yet in double-blind tests carried out at the Chemical Analytical Laboratory of Tsinghua University under the supervision of Professors Lu Zuyin, Li Shengping, and coworkers, an additional peak stretching from 1000 cm^{-1} to 3000 cm^{-1} appeared in the Raman spectrum of preselected sealed tubes of tap-water while Yan claimed to be acting on them. The spectral intensity of the peak was some 15 times higher than the usual

Raman peak of ordinary water at $3430\,\mathrm{cm}^{-1}$ (the O-H stretching mode). No effect was seen in other tubes set aside as controls . Yan is said to have repeated this feat many times[5].

While these experiments involved targets with a trillion trillion electrons[3,4] or a million times more[1,2], I can think of a PK experiment where the target is just a single electron. Furthermore the person acting on the electron can sit near it, and the energy required for the effect will be at least 23 orders of magnitude less. The experiment is to mentally cause an electron in a 50-gauss field to reverse the direction in which its magnetic moment is pointing. Flipping the spin in such a field (100 times Earth's field) will require an energy of only $0.6 \cdot 10^{-6}\,\mathrm{eV}$, or less than $1/1{,}000{,}000$ the energy of a single blue photon.

Actually it is difficult to tell which way an isolated electron's spin or magnetic moment is pointing, but there is a related experiment which *can* tell.

2. THE EXPERIMENT

How can we tell if the electron's spin has reversed direction? One way is to shine a tunable dye laser on the Mg^+ ion and use a property known as laser-induced fluorescence (LIF)[6]: when the laser reaches the right frequency, corresponding to about $280\,\mathrm{nm}$, the ion lights up. If you could see in the UV, then you could see this single ion shining. (Instead the LIF is detected using a UV photo-detector.) If an operator could focus on the rapidly oscillating valence electron and flip its spin (by lowering its energy very slightly), then the finely tuned resonance between the laser and the ion would be lost and the ion would become dark. If the operator could flip the electron's spin once more, then the LIF would be restored and the ion would light up again. Thus if the operator

could create suitable long and short intervals of LIF, then he or she could send a message in International Morse Code. Anyone watching the ion's detected UV signal could read the message. The operator could send the Preamble to the Charter of the United Nations!

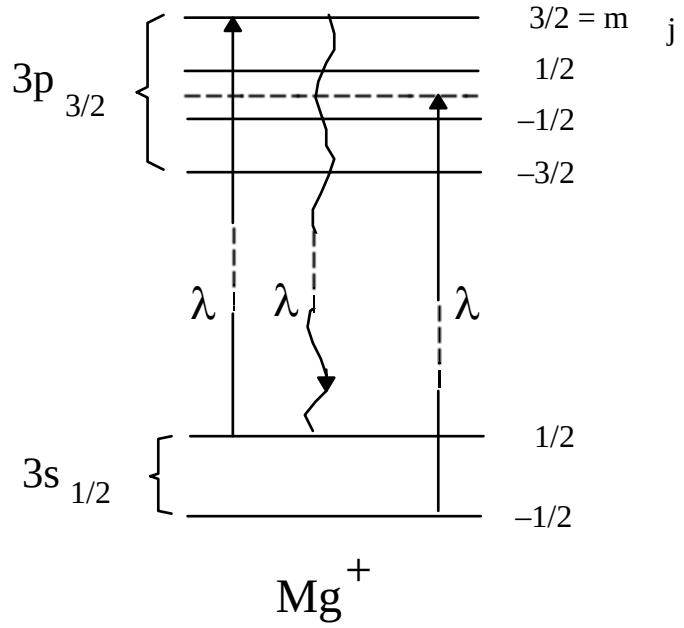

Fig. 1. Relevant energy spectrum of the valence electron of Mg^+ immersed in a weak magnetic field[7]. (The increase in energy from the $3s_{1/2}$ to the $3p_{3/2}$ levels is several orders of magnitude greater than it appears in the sketch.) A 280 nm laser photon excites the valence electron from the upper $3s_{1/2}$ state to the highest $3p_{3/2}$ state. The electron de-excites (wavy line) with the emission of a photon of the same frequency. See text for further details. (There is also a $3p_{1/2}$ state 0.011eV below the $3p_{3/2}$ state, but it plays no role in the LIF described here.)

To see what is happening in LIF, refer to Fig. 1. Suppose that the valence electron is initially in the upper $3s_{1/2}$ ground state. Upon absorbing a 280nm left circularly polarized laser photon, the electron is excited to the top-most

$3p_{3/2}$ sub-state. It then de-excites (wavy line) to the upper ground sub-state as determined by the selection rules, emitting a photon of the same frequency that excited it, but travelling in an arbitrary direction. The electron can go up and down up to 10^8 times per second, emitting up to 10^8 photons per second. This is LIF. A human pupil can accept about 10^4 of these photons each second, so if one were sensitive to $280\,\text{nm}$ light then one could see the ion. (Instead a photo-cell is used.) All the while, the electron's spin stays pointing in the same direction as it goes up and down in energy. Even a slammed door won't flip its spin. (Such complete shielding from physical vibration is extraordinary for a PK experiment.)

Now suppose that by mental intent the operator could flip the electron's spin, or equivalently, lower the electron's energy by $0.6 \cdot 10^{-6}\,\text{eV}$. Then the electron would drop to the lower $3s_{1/2}$ ground sub-state where it would stay because the laser photons would be trying to excite the electron to an energy level which doesn't exist (the dotted line in Fig. 1). If the operator could flip the electron's spin once more, then the electron would rise to the upper $3s_{1/2}$ ground sub-state and the laser photons could restore LIF.

Here are some details on managing the ion. The experimentalist evacuates a glass vessel to a very low state-of-the-art pressure, ~ 10^{-11} torr. Inside the vessel is a Paul trap, consisting of four thin parallel rods each about $1.5\,\text{cm}$ long outlining a mathematical box with a cross section of about $0.5\,\text{cm}^2$. Each rod has three segments, with the middle segment at a lower DC potential than the end segments, say by 20 volts. Mg^+ ions are introduced into the chamber by evaporating atoms from an internal magnesium strip with an electric current, then ionizing the atoms with an electron beam. Most of these ions are ejected from the trap by heating, but one (or more) can be left trapped near the center of the potential well. To keep these ions from escaping out the

sides of the trap, an AC voltage is imposed on the rods[8]. This creates time-averaged side walls for the trap, operating on the same principle as does an alternating gradient synchrotron. Typical voltage and frequency are 300 volts and 7 MHz.

Even at the low pressure of 10^{-11} torr, there remain some 10^6 O_2 and N_2 molecules inside the Paul trap, but on the atomic scale, they are very far apart. The chance that one of them will collide with the Mg^+ ion is slight.

Still the Mg^+ ion must be slowed to allow LIF. Initially near room temperature, the ion is doppler-cooled to a few mK. This enables it to stay in resonance with the laser beam which has a frequency spread of only about a MHz.

Light from the fluorescing ion is focussed on a charge-coupled device (CCD) device sensitive to UV light at very low intensities. The CCD signal is directed to a computer, and with appropriate programming, produces a point of light on the monitor. The position and duration of the point are saved in the computer's memory. The computer can be programmed to recognize long and short-lived points of light as International Morse Code and print the code as plain text.

One might ask, if an electron's spin can be flipped mentally, then why hasn't this been seen before? Perhaps it has, but not recognized because it isn't supposed to be possible.

Consider the analogy of someone who has never seen a bicycle, let alone seen anyone ride one. If shown a bicycle, he or she might have no idea what it is for. And even if this person guessed that it might be a physical conveyance of some sort, he or she might give up trying to ride it before succeeding. Similarly, it might not occur to someone that he or she could mentally flip the spin of an

electron, and even if such a possibility were imagined, the person might give up before acquiring the skill.

On the other hand, someone who has demonstrated PK ability to his or her own satisfaction, might take up the challenge to flip an electron's spin (or lower its energy) in this simple PK experiment. (The author has a list of over a dozen people who believe that they have demonstrated PK ability and would like to try.) If just one person succeeds in flipping the spin, then anyone else attempting it will know that it can be flipped, just as someone watching just one person ride by on a bicycle knows that it can be ridden.

Successfully turning LIF on and off by making the point of light appear and disappear on the computer's screen might be similar to bio-feedback experiments, where, for example, a person can learn to raise or lower his or her blood pressure by watching the pressure readings. No one knows exactly how this is accomplished, but the effect is observed and becomes the starting point for the scientific investigation of the effect.

Successfully turning LIF on and off would be one step further removed, since the person would not be physically connected to the ion. However, if a mental link could be established, then practice for a few minutes, or hours, or days, might enable a volunteer to turn LIF on and off, even though the she or he would not know exactly what s/he had done to affect the ion. This is where the science of the experiment comes in. It would be the starting point for a scientific investigation of the link between the person and the physical ion.

In this regard, controlling LIF might be correlated with a particular mental state, perhaps the θ–α 10 Hz brain-wave state noted for restful, creative thinking. The Monroe Institute near Charlottesville, VA provides a HemiSync binaural audio tape[9] where one hears music in one ear and the same music

10 Hz higher in the other, producing a 10 Hz beat frequency in the brain which helps to bring about the θ–α state.

3. THEORY

If a candidate could succeed in learning to turn LIF on and off at will when seated near the experimental apparatus, then we would have him or her try to repeat the feat on succeeding days. If s/he still could, then we would begin phase 2 of the experiment, where we would have him or her try to turn LIF on and off from across the street, and from across town. (As previously noted, there are some claims that persons have mentally influenced an object when they were far from the target.) If the candidate can still affect LIF at a distance, then we will know that none of the four fields known to contemporary science are responsible: electromagnetic, weak, strong, and gravitational. This might explain why demonstrations of distant PK have been so elusive.

This also introduces the possibility of some very interesting physics. For example, since the candidate's intent has not been weakened by distance, this suggests that his or her intent may be mediated by a soliton, as solitons do not lose strength as they travel. Furthermore, because the intent is not impeded by obstructions like concrete, lab walls, *etc.*, perhaps the soliton travels in higher dimensional space, skating along the particle boundary. This would suggest that the higher space is extended or flat, at least locally, and not mapped onto tightly curved compact spaces (radii ~ 10^{-32} m) as in string theory.

A Cartesian higher dimensional space may not be entirely unreasonable. Rubakov and Shaposhnikov[10] have published a ϕ^4 theory in $4+1$ infinite flat dimensions in which a boson and an electron are trapped by a soliton on a four-

dimensional domain wall (taken to be ordinary space-time), but in which the particles can also propagate freely in the fifth dimension if they have enough energy. The present author has also constructed an elementary-particle model with flat extra dimensions, in this case four Cartesian higher dimensions, which can account for many of the properties of quarks and leptons[11,12, 13].

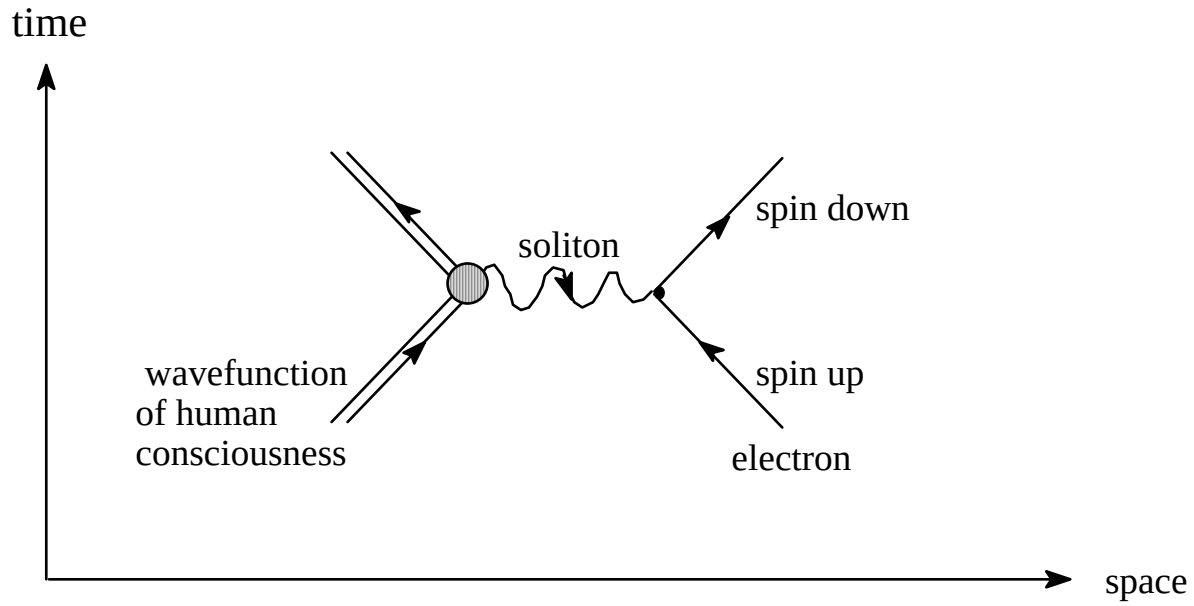

Fig. 2. Human consciousness flipping the spin of an electron in an external magnetic field by means of a hypothetical soliton.

If a successful operator's intent is in fact mediated by a soliton, then the process might proceed something like the Feynman-type diagram in Fig. 2. The human consciousness is represented by a double line suggesting structure.

Of course it is possible that any successful manipulation of the Mg^+ valence electron is due to an entirely different process. A possible mechanism might be quantum entanglement, which also can act over long distances and is insensitive to obstructions. In the classic example[14], two electrons prepared in

a spin-0 state separate by a large distance, yet remain correlated so that if the spin of one of them is measured in an arbitrary direction, then the other's spin quickly (if not instantly) takes the opposite orientation. While such correlations have not been measured for electrons over a distance, they have been observed for pairs of *photons*. Gisin and collaborators[15] have found that when the spin of an entangled photon is measured, the spin of its partner several km distant assumes the opposite direction instantly, or at least in far less time than it would take light to convey the message. How the photons know how each other is oriented is one of the mysteries of quantum mechanics, but this has not stopped a whole industry from starting up to exploit this property of quantum interference to build quantum computers, exponentially faster than current integrated-circuit computers. For references to papers in this field, see Ref. 16.

One might speculate that if an operator were in a suitable meditative state, perhaps the 10 Hz θ–α state mentioned above where the two halves of the brain are in synchrony, then the brain's electronic fields might be coherent or partly coherent. If these fields' wavefunction could somehow become entangled with the Mg^+ valence electron's wavefunction, then a change in the operator's mental state might affect the valence electron's spin. Such a change in LIF might indicate that the human electronic field and the electron's wavefunction are correlated.

4. DISCUSSION

An electromagnetic wave can cause an electron to oscillate, and forcing an electron to oscillate will create an electromagnetic wave. If a human could generate a soliton which would flip an electron's spin, then perhaps flipping the

electron's spin (say with an RF generator) could generate another soliton. If this soliton were detected by a second Mg^+ ion, say, then one could start to map out the physics objectively. For example, one might be able to measure the speed with which the signal travels from the emittor to the detector. If it were greater than $c = 3 \cdot 10^8$ m/s. then we would know that the signal is travelling outside the lower 3 + 1 dimensions of space-time, consistent with the soliton model (and perhaps also with the entanglement model).

Sending messages through LIF would be a great boon to persons who have lost muscle control. They could communicate or even write technical papers using suitably augmented Morse Code. If the afflicted person could control the ion from a distance, then it might not be necessary for him or her to be near the experimental apparatus.

It is our hope that if our experiment is successful, then well equipped atomic-physics laboratories around the world will try to reproduce our results. We will describe how we achieved this effect as clearly as possible to facilitate verification in other labs.

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References

[1] L. Dossey, *Reinventing Medicine* (HarperCollins, New York, NY, 1999).

[2] Wayne B. Jonas and Cindy C. Crawford, "Science and spiritual healing: a critical review of spiritual healing, 'Energy' medicine, and intentionality", *Alternative Therapies Supplement: Definitions and Standards in Healing Research* **9**, A56 (2003).

[3] X. Yan, F. Lu, M. Jiang, X. Wu, W. Cao, Z. Xia, H. Shen, J. Wang, M. Dao, H. Lin, and R. Zhu, "Certain physical manifestations and effects of external qi of Yan Xin Life Science Technology", *Journal of Scientific Exploration* **16**, 381–411 (2002).

[4] Z. Lu, *Scientific Qigong Exploration*, Engl. trans. Hui Lin and Ming Dao; (Amber Leaf Press, Malvern, PA, 1997).

[5] Ming Dao (private communication). Dr. Dao is currently employed as a physicist in the Department of Materials Science at the Massachusetts Institute of Technology

[6] A. E. Siegman, *An introduction to lasers and masers* (McGraw-Hill, New York, NY, 1971)

[7] C. E. Moore, *Atomic Energy Levels, Volume I.* National Bureau of Standards 35/Vol.1, (reprint of NBS Circular 467, Vol. 1, Gaithersburg, MD, 1971).

[8] Paul W, Osberghaus and E, Fischer Ion cage. In: *Forschungsberichte des Wirtschaft und Verkehrministeriums Nordrhein Westfalen (no.415).* (Westdeutscher Verlag, Wiesbaden, Germany, 1958).

[9] Robert Monroe, "Wave III. Freedom 2", *Gateway Experience, CD #GE045C,* (Interstate Industries, Lovingston, VA, 2000).

[10] V. A. Rubakov and M. E. Shaposhnikov, "Do we live inside a domain wall?", *Physics Letters B* **125**, 136–139 (1983).

[11] R. A. Bryan, "Isoscalar quarks and leptons in an eight-dimensional space", *Physical Review D* **34**, 1184–1193 (1986).

[12] R. A. Bryan, "Are quarks and leptons dynamically confined in four flat extra dimensions?", *Nuclear Physics B* **523**, 232–242 (1998).

[13] R. A. Bryan, "Are the Dirac particles of the Standard Model dynamically confined states in a higher dimensional flat space?", *Canadian Journal of Physics* **77**, 197–210 (1999); http://arXiv.org/abs/hep-ph/9904218

[14] D. Bohm *Quantum theory.* (Prentice-Hall, New York, NY, 1951).

[15] N. Gisin, "Sundays in a quantum engineer's life," Talk presented at the *Conference in Commemoration of John S. Bell* (Vienna, November 10–14, 2000). http://xxx.lanl.gov/abs/quant-ph/0104140.

[16] http://www.qubit.org